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IS 12043-1 (1987): Electrical Connectors for Aircraft, Part 1: General Requirements [TED 14: Aircraft and Space Vehicles]



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Indian Standard "भारतीय मानक १२०४३"

SPECIFICATION FOR "RE-AFFIRMED 1992"

ELECTRICAL CONNECTORS FOR AIRCRAFT

PART 1 GENERAL REQUIREMENTS

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BUREAU OF INDIAN STANDARDS
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*Indian Standard*SPECIFICATION FOR
ELECTRICAL CONNECTORS FOR AIRCRAFT**PART 1 GENERAL REQUIREMENTS**

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IS : 12043 (Part 1) - 1987

(Continued from page 1)

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Indian Standard

SPECIFICATION FOR ELECTRICAL CONNECTORS FOR AIRCRAFT

PART 1 GENERAL REQUIREMENTS

0. F O R E W O R D

0.1 This Indian Standard (Part 1) was adopted by the Indian Standards Institution on 25 March 1987, after the draft finalized by the Aircraft Electrical Equipment Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard (Part 1) covers the basic design, mechanical and electrical requirements for aircraft electrical connectors and also the basic environmental conditions of operation. The requirements and methods of tests are covered under Part 2 of this standard.

0.3 This standard is not intended for a particular type of connector. For a specific range of connectors to be considered as being in conformity with this standard, a detailed specification for the range may be referred (*see* Appendix A).

0.4 In preparing this standard assistance has been derived from the following:

ISO 1949-1973 (E) 'Design requirements for aircraft electrical plug and socket connectors', issued by the International Organization for Standardization.

MIL-C-005015 F 'Electrical connectors, aircraft', issued by USA, Department of Defence.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard (Part 1) specifies the basic design, mechanical and electrical requirements for aircraft electrical connectors, and also the basic environmental conditions of operation.

1.2 This standard applies to types of connectors designed to use crimped, soldered and welded contacts accommodating aircraft cables. It does not define a particular type of connector dimensionally.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Barrel (Conductor) — That part of the contact which is designed to accommodate the conductor.

2.2 Barrel (Insulation) — (Also known as insulation bucket). That part of the contact which is designed to accommodate the conductor insulation.

2.3 Bunch Rating — The current rating (derating) applied to specific number of cables when formed into looms that is bunched together.

2.4 Cable Clamp — A part of a connector or an accessory attached to the connector body to support the cable or wire to provide stress relief and absorb mechanical stress which would otherwise be transmitted to the termination.

2.5 Cable Outlet — A part of a connector or an accessory consisting of rigid housing for attachment to the connector body. It may incorporate provision for a cable clamp or seal for terminating screens, and provide shielding to electrical interference (may be straight or angled).

2.6 Connector, Electrical — A component which permits the termination of conductors for the purpose of providing connection and disconnection to a suitable mating component.

2.7 Connector Fixed — A connector for attachment to a rigid surface.

2.8 Connector Free — A connector for attachment to the free end of a wire or a cable.

2.9 Connector Interface — The two surfaces of the contact side of a pair of connectors which face each other when the connectors are mated.

2.10 Contact Holding Force — The force which is required to retain a male contact gauge of specified weight and size in a female contact.

2.11 Contact Pin (or Contact Male) — A contact having an engaging end which makes contact by insertion into a female socket.

2.12 Contact Retention Force — The axial force in either direction which a contact can withstand without being permanently displaced from its position within the insulator.

2.13 Contact Socket (or Contact Female) — A contact having an engaging end which will accept entry of a male contact.

2.14 Coupling — The mechanical device used to mate and retain a pair of connectors in correct engagement with each other.

2.15 Crimped Contact — A contact with the conductor barrel designed to be physically compressed (deformed) around the conductor to make good electrical and mechanical contact.

2.16 Datum Checks — Checks designed to establish that all parts of the specimens are in conformity with the detail drawings.

2.17 Generic Type — Type having the same general characteristics.

2.18 Insert — An insulating element designed to support and position contacts in a connector.

2.19 Insert Retention — Ability of the insert to withstand specified axial load in either direction without being dislodged from its normal position within the shell.

2.20 Key — A projection which engages with a keyway to guide a connector during mating.

2.21 Keyway — The slot or groove in which a key engages.

2.22 Mated Pair — A combination, when mated, of two connectors designed for being coupled.

2.23 Orientation — A secondary polarization system designed to prevent, by rotation of the keys from the normal cross connection of connectors having the same shell and contact arrangements.

2.24 Plug (Electrical) — An interconnecting device carrying a preponderance of male contacts for connection with a corresponding socket.

IS : 12043 (Part 1) - 1987

2.25 Polarization — The provision of features on mating connectors to prevent incorrect mating.

2.26 Restricted Entry — Socket contact or insert hole design, which prevents permanent distortion of the socket contact by a male contact or test probe.

2.27 Scoop — The action of touching contacts with the front edge of the mating shell during the search for correct engagement of connectors.

2.28 Shell — The outside case of a connector into which the insert and contacts are assembled.

2.29 (Socket Electrical) — An inter-connecting device carrying a preponderance of female contacts for connection to a corresponding plug.

2.30 Interchangeable — A component is interchangeable when it meets the original performance specifications and is intermountable. In the case of connectors interchangeability applies only to connector mated sets, since individual connectors are not necessarily intermateable.

2.31 Intermateable — Two connectors are intermateable when they are capable of being connected electrically and mechanically but without regard to their performance and intermountability.

2.32 Intermountable — Two components are intermountable when their mechanical mounting parameters are identical without regard to intermateability or interchangeability.

3. CLASSIFICATION

3.1 The electrical connectors for aircraft shall be classified depending upon their class, size, type and insert arrangements and styles. However, temperature (*see* 5.1) and sealing (*see* 5.3) are the only classifications imposed by this standard.

4. MATERIAL AND CONSTRUCTION

4.1 Whenever dissimilar metals are employed in intimate contact with each other in a connector or in a mated pair of connectors, suitable protection against electrolytic corrosion shall be provided. All parts shall be made of materials which are classed as non-magnetic except where specified.

4.2 Contact Materials — Contacts shall be made of suitably conductive materials. Thermocouple contacts shall be made of a material compatible with the thermocouple wire to which attachment is intended and may be magnetic.

4.3 Contact Plating

4.3.1 Crimp type and solder type contacts shall be silver plated according to IS : 1067-1981* or gold plated according to IS : 3266-1982†.

4.3.2 Thermocouple type contacts shall be cadmium plated according to IS : 1572-1968‡. Accessory members of the socket contacts need not be plated but shall comply with the requirements of 4.1.

4.4 Dielectric Material — All inserts and grommets shall be of high grade dielectric having hardness, electric and mechanical characteristics suitable for the purpose intended.

4.5 Contact Spacing and Alignment — Minimum mechanical spacing and creepage distance shall be as specified by the manufacturer depending upon the service rating of the connector. Inserts for socket contacts shall provide an overall side play of socket contacts to facilitate alignment of mating pin contacts.

5. ENVIRONMENTAL CONDITIONS

5.1 Temperature Range — Connectors shall be classified as follows according to the maximum working temperature for which they are suitable:

Class 1 — 65 to $\pm 155^{\circ}\text{C}$

Class 2 — 65 to $\pm 200^{\circ}\text{C}$

A fireproof version, if available, shall be identified by a suffix F.

5.2 Altitude — Connectors shall be suitable for operation at altitudes up to 31 000 m.

5.3 Sealing Classification — Connectors shall be classified as follows according to the sealing for which they are suitable.

*Specification for electroplated coatings of silver for decorated and protective purposes (*second revision*).

†Specification for electroplated coatings of gold for general engineering purposes (*first revision*).

‡Specification for electroplated coatings of cadmium on iron and steel (*first revision*).

IS : 12043 (Part 1) - 1987

Class H Hermetic (fixed connectors or bulkhead types only) sealed to leakage rate of 1×10^{-7} cm³/s at a differential pressure of 100 kN/m².

Class N Sealed to a leakage rate not exceeding 15 cm³/h at a differential pressure of 100 kN/m².

5.4 Vibration Acceleration and Climatic Proofness — The connectors shall be so designed and constructed as to satisfy the test requirements in Part 2 of this standard in respect of vibration, acceleration and climatic conditions.

5.5 Explosion Proofness — The engaged connectors complying with this standard do not normally constitute an explosion hazard but must be disengaged in an explosive atmosphere while carrying current.

5.6 Resistance to Fluids — The connectors shall be so designed, together with their accessories, as to be resistant to aircraft fluids. Any limitations in this respect should be declared in the detail specification and on a declaration of design performance.

5.7 Salt Spray — The materials, finishes and design of the connectors shall be such as to resist contamination by salt spray sufficient and shall be sufficient to meet the requirements of 5.24 of Part 2 of this standard.

5.8 Dust — If required by the purchaser, the connector shall comply with the requirements of IS : 8252 (Part 7)*.

5.9 Magnetic Interference — The connectors and their accessories shall be designed to satisfy the requirement of 5.19 of Part 2 of this standard.

6. MECHANICAL REQUIREMENTS

6.1 Engagement — Correct engagement shall be achieved by the combined use of both the systems specified below. No connector pair in any shell size or type of any orientation or polarization position, even if carrying like contacts, shall make or allow the coupling mechanism to engage, except those items which are truly intended to be mated pairs.

*Environmental tests for aircraft equipment: Part 7 Sand and dust (under preparation).

6.1.1 Shell-to-Shell Keying — Keys and keyways shall be provided to ensure:

- a) that the axis of the male shell remains substantially coincident with the axis of the female shell during the search for correct engagement;
- b) that, for circular connectors, each shell has not less than three keys and/or keyways widely disposed and that the keyways are not open slots in the shell but 'blind' keyways; and
- c) that the angular coincidence of the shells precedes the operation of the insert keying system.

6.1.2 Insert-to-Insert Keying — Insert keying shall be provided to ensure:

- a) that all contacts are correctly aligned and engaged, the contacts being mechanically engaged prior to engagement of the coupling device; and
- b) that it is impossible to engage an insert of a particular contact arrangement with any other contact arrangement in the connector.

NOTE 1 — Contact disposition is not to be used for the purpose of insert-to-insert keying.

NOTE 2 — Orientation by insert rotation is specifically prohibited.

6.2 Coupling — The coupling arrangement shall ensure:

- a) that full engagement and disengagement, the maximum forces for which shall be declared, can be achieved without the use of tools;
- b) that the male and female shells are retained in the correct position when engaged, and that correct engagement can be visually checked;
- c) that in the coupling, devices such as screw threads, bayonet tracks or cams are preferably accessible for cleaning; and
- d) that contacts cannot be scooped, bent or otherwise deformed by the mating plugs or receptacles of like sizes.

6.3 Engagement Endurance — Connectors shall be capable of at least 500 engagements.

6.4 Thread Form — Screw threads shall comply with the relevant established standards.

6.5 Inserts

6.5.1 Inserts for housing female contacts should be of the hard-faced, restricted entry type.

6.5.2 Inserts for Class N connectors carrying either male or female contacts shall be capable of being contained in either fixed or free shells.

6.5.3 Inserts for Class N connector shall provide adequate cable insulations support and shall be capable of accepting a full complement of the maximum size of cable of the type declared by the manufacturer.

6.6 Contacts

6.6.1 Crimped contacts, when used, shall satisfy the requirements of detail specification and control drawing.

6.6.2 The hardness of the crimped barrel portion of all contacts, except the thermocouple types, shall be within the range of 60 to 110 HV. The crimped barrel portion of the contacts shall also contain an inspection hole to prove correct insertion of the conductor within the barrel.

6.6.3 Female contacts shall be of the restricted entry types.

6.6.4 Means shall be provided to lock the contacts axially within the insert. Any movable part of the locking device should preferably not be part of the contact.

6.6.5 The contact locking device should be capable of replacement in the event of damage.

6.7 Declared Engagement (Contacts) — The manufacturer shall declare for each contact shell combination in the detail specification the maximum and minimum mechanical engagement of contact which will ensure effective electrical contact having regard to the accumulative tolerances on all detail parts.

The minimum engagement shall be that which obtains when the free member has moved to the outward limit of any travel permitted by the correctly engaged coupling device.

6.8 Sealing

6.8.1 Class N connectors should preferably be sealed against air pressure at the following points:

- a) Fixed or bulkhead member to panel;

- b) Insert to shell;
- c) Connector interface, and preferably shell to shell;
- d) Cable entry; and
- e) Contact to insert.

6.8.2 Filler plugs, as specified by the manufacturer, may be used on those cable ways which are not wired.

6.8.3 The manufacturer shall detail any special method of sealing when using small diameter cables.

6.8.4 Class H connectors shall be sealed at all points as described in **6.8.1** except (e).

7. ELECTRICAL REQUIREMENTS

7.1 Voltage — The working voltages of the engaged (or capped) connectors between contacts and between contacts and shell under any natural combination of the environmental conditions shall be at least 350 V dc or ac peak.

The connectors shall satisfy the requirements of **5.13** of Part 2 of this standard.

7.2 Current Rating — Four sizes of contacts, 22 and smaller, 20, 16 and 12, shall be provided to accommodate standard conductors not larger than size 12. Individual contacts, when assembled in the connector, shall be capable of carrying the appropriate cable bunch rating under equivalent conditions.

7.3 Insulation Resistance -- The connectors shall satisfy the insulation requirements of **5.5** of Part 2 of this standard.

7.4 Contact Resistance — The connector shall satisfy the requirements of **5.4** of Part 2 of this standard.

7.5 Shell-to-Shell Conductivity — Stable low resistance continuity shall be obtained between engaged connectors to satisfy the requirements of **5.6** of Part 2 of this standard.

8. IDENTIFICATION

8.1 Contact Identification — Contacts for Class N connectors shall be marked only by the manufacturers symbol. The marking shall not distort the contact dimensions or shape beyond the drawing limits.

8.2 Contact Position Identification

8.2.1 Unless otherwise agreed, the arrangement and identification of contacts shall be as specified in **8.2.2** and **8.2.3**.

8.2.2 All contacts shall be arranged in parallel straight rows in one plane. Identification of the contact position shall be provided. This shall be numerical, the commencement and direction of count in every line being indicated by an arrow.

8.2.3 A means of affording rapid identification of contact position shall be provided. This shall be legible, permanent, unambiguous, and in a contrasting colour to that of the insert. It shall not affect the sealing or electrical performance of the connector.

8.3 Connector Identification — The identification of the connector shall be legible and permanent. It shall appear on the body or shell.

8.4 Accessory Identification — Each accessory item shall be legibly and permanently identified. There shall be no single reference number for the complete assembly of the connector with its accessories.

9. FIXING AND ACCESSORIES

9.1 Attachment Methods — Three basic types of fixed shells shall be provided, as follows:

- a) Panel mounting, suitable for wall and box mounting;
- b) Jamb nut mounting (Class N or H) (circular connectors only);
and
- c) Hermetic solder/welded mount.

9.2 Panel Thickness — Panel mounting shells shall accommodate panel thicknesses varying between 0.7 mm and 3.3 mm. Jamb nut shells shall accommodate panels of maximum thickness 6.5 mm.

9.3 Screening (Shielding) — Provision shall be made for terminating all types of cable screening overall cable screen, individual core screens or groups of core screens, bonded to or insulated from the connector shell.

9.4 Cable Outlets — Straight and elbow outlets shall be provided. These outlets should be capable of fitting to either free or fixed connectors of the same shell size without adaptation.

9.5 Protective Caps — Protective caps fitted by normal connector engagement methods shall be available to provide protection against ingress of moisture or foreign matter, to protect live contacts and to preserve the performance of disengaged, live items. Caps shall be provided with a means of retention to the connector by a link chain or equivalent.

9.6 Cable Clamps — Provision may be made for cable clamps when the particular design necessitates the use of separate strains relievers.

10. QUALITY ASSURANCE PROVISIONS

10.1 Production and quality tests shall be conducted in accordance with the provisions of the appropriate individual specifications for the particular range of plugs and sockets.

A P P E N D I X A

(Clause 0.3)

INFORMATION TO BE INCLUDED IN DETAIL SPECIFICATION

A-1. The detail specification shall include the following information:

A-1.1 Description of connectors.

A-1.2 Marking and packaging.

A-1.3 Ordering information.

A-1.4 Drawings sufficiently dimensioned to ensure:

- a) Contact arrangements and polarization;
- b) Intermateability and interchangeability;
- c) Outline dimensions, panel cut outs and mass;
- d) Accessories, outline dimensions and mass;
- e) Assembly tools;
- f) Gauges;
- g) Contacts, outline dimensions and mass; and
- h) Crimp tools, their locators and positioners.

IS : 12043 (Part 1) - 1987

A-1.5 Ratings:

- a) Electrical;
- b) Environmental; and
- c) Endurance.

A-1.6 Characteristics:

- a) Electrical; and
- b) Mechanical.

A-1.7 Details to be included in tests records.

A-1.8 Additional information.